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STEVEN L. NICHOLS
RADER, FISHMAN & GRAUER PLLC
10653 S. RIVER FRONT PARKWAY
SUITE 150
SOUTH JORDAN, UT 84095

EXAMINER	
PETERSON, CHRISTOPHER K	

ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/728,393	GENG, Z. JASON	
	Examiner	Art Unit	
	CHRISTOPHER K. PETERSON	2622	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 18 November 2009.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 32-36,61,62 and 65-73 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 32-36,61,62 and 65-73 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The Amendment After Non-Final Rejection filed on 11/18/2009 has been received and made of record. Examiner notes that the Applicant has added new claim 73 and amended claims 66 - 72. Claims 32 - 36, 61, 62, 65 - 73 are pending in this application.

Priority

2. Examiner notes Applicant requests a copy of Yukhin's Provisional Patent Application No. 60/383,216 filed May 22, 2002. A copy of the application will be provided with this communication.

Response to Arguments

3. Applicant's arguments filed 11/18/2009 have been fully considered but they are not persuasive.

First, in regard to claims 32 and 65, the Applicant argues that Yukhin reference does not teach the "sequential light beam projections" (See Remarks, Pg. 8 - 11). The Examiner respectfully disagrees. Specifically, the Yukhin reference, Fig. 4, 5, and 6 and Para 43, 54, and 58 shows the limitation "sequential light beam projections". Yukhin teaches the control unit 402 may also control temporal functions, such as the length of time or frequency of the illumination. The Examiner analyzes the limitation of temporal

functions to mean limited or length of time. Yukhin teaches the structured illumination from the N sources is projected by an optical system, e.g., an afocal optical system, on the object's surface, distorted by a surface relief of the object and collected by the N photodetectors. The collected images are converted by corresponding electronic units to digital signals and preprocessed (Para 43). Yukhin teaches the signal processor 420 may control illumination unit 401 and detecting unit 405 via control units 402 and 406 (Para 56) Yukhin teaches the control unit 406 transmits timing and control signals to detecting unit 405. Detecting unit 405 may be positioned to receive primarily light transmitted from a neighboring illumination unit and reflected from the surface of an object in the area or transmitted from an opposing illumination unit and passing through the area (Para 58). Examiner analyzes this to mean the control unit 402 controls the timing of each illuminating unit 401 and control unit 406 controls the timing of detecting unit 405 to receive primarily light transmitted from a neighboring illumination unit 401. For the above reasons, the Examiner believes the Yukhin reference does teach the limitations of claims 32 and 65, and the rejection to the claim will be set forth below.

Secondly, in regard to claims 32, the Applicant argues that Yukhin reference does not teach the "different colors" (See Remarks, Pg. 8 - 9). The Examiner respectfully disagrees. Specifically, the Yukhin reference, Fig. 4 and 5 and Para 60 – 63, shows the limitation "different color". Yukhin teaches one or more light source 510A-510N can generate light of a different spectral range , for example, ranges of the ultraviolet, visible and infra-red spectra of electromagnetic radiation (Para 61). Yukhin teaches the light sources can generate light from different spectral ranges. Claim 32

cites the light beam projections having different colors. Claim 32 does not read the light beam projections each of a different color **within the visible spectrum**. Examiner analyzes the light source of Yukhin can generate light of different colors from different spectral ranges. For the above reasons, the Examiner believes the Yukhin reference does teach the limitations of claims 32, and the rejection to the claim will be set forth below.

Thirdly, in regard to claims 32, the Applicant argues that Yukhin reference does not teach the "3 CCD monochromatic sensors" (See Remarks, Pg. 11). The Examiner respectfully disagrees. Specifically, the Yukhin reference, Fig. 4 and 5 and Para 68, shows the limitation "3 CCD monochromatic sensors". Yukhin teaches detectors 642A-642N may be one or more of, for example, CCDs, CMOSs, or any other suitable sensor array detecting device (Para 68). Claim 32 does not cite the limitation "3 CCD monochromatic sensors", but the limitation is found in claim 34. Examiner analyzes monochromatic to mean pertaining to light of one color or to radiation of a single wavelength or narrow range of wavelengths. Monochromatic sensors are not limited to **the visible spectrum of light.** For the above reasons, the Examiner believes the Yukhin reference does teach the limitations of claim 34, and the rejection to the claim will be set forth below.

In regard to claims 35, the Applicant argues that Yukhin reference does not teach the "Rainbow-type image" (See Remarks, Pg. 12). The Examiner respectfully disagrees. Specifically, the Yukhin reference, Fig. 5 and 6 and Para 70 - 75, shows the limitation "3 CCD monochromatic sensors". Yukhin teaches processor 670 may

determine the coordinates values (X,Y) of the object's surface. As a result, each line (or strip) in the "overall" digital image may have a unique number in binary code. Based on the summarized codes, processor 670 can then calculate the distance, Z, and corresponding pairs of coordinates because distances between the strips forming structural illumination differ on the registered picture. Yukhin teaches a method of capturing a plurality of images with different patterns and spectral ranges and combines the plurality of images to create a 3D image by calculating the distance, Z, and corresponding pairs of coordinates because distances between the strips forming structural illumination differ on the registered picture. Applicant argues the claim cites a "Rainbow-type image" and Yukhin does not teach a "Rainbow-type image". Applicant cites a "Rainbow-type image" is meant to be understood as an image or a camera configured to collect an image that may be used to form a three-dimensional image according to the triangulation principles (Para 26). Examiner analyzes Yukhin to provide a 3D image using triangulation principles. For the above reasons, the Examiner believes the Yukhin reference does teach the limitations of claim 35, and the rejection to the claim will be set forth below.

In regard to claims 61, the Applicant argues that Yukhin reference does not teach the "mosaic means" (See Remarks, Pg. 13). The Examiner respectfully disagrees. Specifically, the Yukhin reference, Fig. 6 and Para 70 - 75, shows the limitation "overall digital image ". Yukhin teaches the processor 670 of electronic unit 690 may sum the signals received from each of signal processors 660A-660N to create a "overall" digital image (Para 75). Applicant cites Yukhin does not teach or suggest mosaic means

combining three separate color image data sets to form a 3D image of an object. Examiner analyzes mosaic image to mean a process of producing an image by using small pieces of different spectral light to create an overall image. For the above reasons, the Examiner believes the Yukhin reference does teach the limitations of claim 61, and the rejection to the claim will be set forth below.

In regard to claims 62, the Applicant argues that Yukhin reference does not teach the “narrow band spectral filter" (See Remarks, Pg. 13). The Examiner respectfully disagrees. Specifically, the Yukhin reference, Fig. 6 and Para 72 and 73, shows the limitation "narrow band spectral filter". Yukhin teaches each of the N spectral ranges is registered by at least one corresponding photoregistrar of identical spectral sensitivity. Digital images differ from another because of the adjustment of the spectral range (Para73). Yukhin teaches that each photoregistrar is registered to capture the corresponding spectral range. Examiner analyzes this to mean each photoregistrar is monochromatic, as cited above. Each photoregistrar is adjusted or filtered to a specific spectral range. For the above reasons, the Examiner believes the Yukhin reference does teach the limitations of claim 61, and the rejection to the claim will be set forth below.

Claim Rejections - 35 USC § 102

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 32 – 36, 61, 62, and 65 - 72 are rejected under 35 U.S.C. 102(e) as being anticipated by Yukhin (US Patent Pub. # 2003/0235335).

As to claim 32, Yukhin (Figs. 4, 5, and 6) teaches a high speed 3D surface imaging camera comprising:

- a light projector (illuminating unit 401) for selectively illuminating an object, (Para 54) said light projector (401) being configured to project three sequential light beam projections having different colors (light source 510A-510N) and different spatially varying intensity patterns (SLMs 515A-515N) from said projector (401) onto said object (Para 54 and 60 – 63). Yukhin teaches control unit 402 may control the spatial structure of the projected patterns that is control unit 402 may control whether illuminating unit 401 illuminates objects in an area evenly or whether it projects a pattern onto the objects. Control unit 402 may also control temporal functions, such as the length of time or frequency of the illumination. In addition, control unit 402 may also control spectral modulations, such as, for example, the wavelength of the generated light (Para 54). Yukhin teaches "N" hereinafter represents a variable (Para 60). Examiner analyzes the limitation "N" to mean 3. Yukhin teaches the SLMs 515A-515N may be used as code masks with, for example, patterns such as grids, or line structures and used for determining a pattern of light projected onto the object 560 (Para 63).

- an image sensor (detector 642A – 642N) configured to receive reflected light from said object (object 695) and to generate three separate color image data sets (signal processor 660A – 660N) based on said three sequential differently colored (light source 510A-510N), variable intensity pattern light beam projections (SLMs 515A-515N) said three separate color image data sets (660A – 660N) providing said 3D image data of said object (695) (Para 58, 66 – 68, and 75). Yukhin teaches the control unit 406 transmits timing and control signals to detecting unit 405 (Para 58). Yukhin teaches the resultant processed digital signal such as reconstructed 3D topology from signal processors 660A-660N may be accumulated in electronic unit 690. For example, processor 670 of electronic unit 690 may sum the signals received from each of signal processors 660A-660N to create an "overall" digital image (Para 75).

As to claim 33, Yukhin teaches the high speed 3D surface imaging camera of claim 32, wherein said image sensor comprises a plurality of charge-coupled device sensors (642A- 642N) (Para 68).

As to claim 34, Yukhin teaches the high speed 3D surface imaging camera of claim 33, wherein said plurality of CCD sensors (642A- 642N) comprises 3 CCD monochromic sensors (642A- 642N) (Para 68 and 73). Yukhin teaches additional lens 620A-620N may be located in each of the N channels formed by beam splitter 615 and project images of the structured illumination distorted by an object's surface onto detectors 642A-642N (Para 68). Examiner reads N channels to mean 3 CCD sensors.

Yukhin teaches structured illumination using differing spectral ranges is used; each of the N spectral ranges is registered by at least one corresponding photoregistrar of identical spectral sensitivity. Examiner analyzes “N spectral ranges are registered by at least one corresponding photoregistrar” to mean each photoregistrar (Fig. 5 detector 642 and ADC 644) is monochromic and only reads a specific spectral range.

As to claim 35, Yukhin teaches the high speed 3D surface imaging camera of claim 32, further comprising a computing device (electronic unit 690) communicatively coupled to said image sensor (642A – 642N) wherein said computing device (690) is configured to combine said separate color image data sets (660A – 660N) into a composite Rainbow-type image of said object (Para 70 - 75). Yukhin teaches the resultant processed digital signal such as reconstructed 3D topology from signal processors 660A-660N may be accumulated in electronic unit 690. For example, processor 670 of electronic unit 690 may sum the signals received from each of signal processors 660A-660N to create an "overall" digital image (Para 75).

As to claim 36, Yukhin (Fig. 4 and 5) teaches a control unit (402) which produces sequential color projections comprises one of a rotatable color wheel, a deformable mirror, or a sequential RGB light emitting diode array (Para 53 and 54). The one or more light source 510A-510N can generate light of a different spectral range, for example, ranges of the ultraviolet, visible and infra-red spectra of electromagnetic radiation (Para 61). Yukhin teaches a signal processor 420 that controls the control unit 402 for the illuminating unit 401 and control unit 406 for the detecting unit 405. Yukhin teaches the illuminating unit 401 may be any suitable light-emitting device such as, for

example, laser, light-emitting diode ("LED"), inert gas lamp, incandescent lamp or other working in visible, ultraviolet or infrared range. In certain embodiments, the illumination is provided by a flash or strobe light, which has a very short duration and consequently may be preferable when illuminating moving objects (Para 53).

As to claim 61, Yukhin teaches the high speed 3D surface imaging camera of claim 32, further comprising a computing device (electronic unit 690) communicatively coupled to said image sensor (642A – 642N), wherein said computing device (690) further comprises a mosaic means configured to combine said three separate color image data sets (660A – 660N) to form a multi-view 3D image of said object (Para 70 – 75).

As to claim 62, Yukhin teaches the high speed 3D surface imaging camera of claim 34, wherein each of said 3 CCD monochromatic sensors (642A - 642N) comprise a matched narrow-band spectral filter disposed in front of said CCD sensor (642A - 642N) (Para 72 and 73). Yukhin teaches each of the N spectral ranges is registered by at least one corresponding photoregistrar of identical spectral sensitivity. Digital images differ from another because of the adjustment of the spectral range (Para73). Yukhin teaches that each photoregistrar is registered to capture the corresponding spectral range. Examiner analyzes this to mean each photoregistrar is monochromatic, as cited above. Each photoregistrar is adjusted or filtered to a specific spectral range.

As to claim 65, Yukhin (Figs. 4, 5, and 6) teaches a 3D imaging camera comprising:

- a light projector (illuminating unit 401) for selectively illuminating an object, (Para 54) said light projector (401) being configured to project a number of sequential light beam projections having different wavelengths (light source 510A-510N) and different spatially varying intensity patterns (SLMs 515A-515N) from said projector (401) onto said object (Para 54 and 60 – 63). Yukhin teaches control unit 402 may control the spatial structure of the projected patterns that is control unit 402 may control whether illuminating unit 401 illuminates objects in an area evenly or whether it projects a pattern onto the objects. Control unit 402 may also control temporal functions, such as the length of time or frequency of the illumination. In addition, control unit 402 may also control spectral modulations, such as, for example, the wavelength of the generated light (Para 54). Yukhin teaches "N" hereinafter represents a variable (Para 60). Examiner analyzes the limitation "N" to mean a number. Yukhin teaches the SLMs 515A-515N may be used as code masks with, for example, patterns such as grids, or line structures and used for determining a pattern of light projected onto the object 560 (Para 63).
- an image sensor (detector 642A – 642N) configured to receive reflected light from said object (object 695) and to generate a number of separate color image data sets (signal processor 660A – 660N) based on said a number of sequential differently colored (light source 510A-510N), variable intensity pattern light beam projections (SLMs 515A-515N) said three

separate color image data sets (660A – 660N) providing said 3D image data of said object (695) (Para 58, 66 – 68, and 75). Yukhin teaches the control unit 406 transmits timing and control signals to detecting unit 405 (Para 58). Yukhin teaches the resultant processed digital signal such as reconstructed 3D topology from signal processors 660A-660N may be accumulated in electronic unit 690. For example, processor 670 of electronic unit 690 may sum the signals received from each of signal processors 660A-660N to create an "overall" digital image (Para 75).

As to claim 66, Yukhin teaches the 3D imaging camera claim 65, in which said light projector (401) is further configured to project light beams in the near infrared spectrum (infrared range), and said image sensor (642A – 642N) is further configured to receive light in the near infrared spectrum (Para 53 and 73). Yukhin teaches structured illumination using differing spectral ranges (infrared spectrum) is used, each of the N spectral ranges is registered by at least one corresponding photoregistrar (640A – 640N) of identical spectral sensitivity (Para 73).

As to claim 67, Yukhin teaches the 3D imaging camera claim 65, in which said image sensor (642A – 642N) is configured to receive said number of sequential light beam projections (510A-510N) sequentially within a single frame cycle (Para 95). Yukhin teaches the system can continuously capture 3D images at a fast rate; the probability of error is low and decreases as the number of frames taken increases.

As to claim 68, Yukhin teaches the 3D imaging camera claim 65, in which said image sensor (642A – 642N) comprises a number of charge-coupled device (CCD) sensors (Para 55).

As to claim 69, Yukhin teaches the 3D imaging camera claim 68, in which said CCD sensors (642A- 642N) comprises monochromatic CCD sensors (642A- 642N) (Para 68 and 73). Yukhin teaches additional lens 620A-620N may be located in each of the N channels formed by beam splitter 615 and project images of the structured illumination distorted by an object's surface onto detectors 642A-642N (Para 68). Examiner reads N channels to mean 3 CCD sensors. Yukhin teaches structured illumination using differing spectral ranges is used; each of the N spectral ranges is registered by at least one corresponding photoregistrar of identical spectral sensitivity. Examiner analyzes "N spectral ranges are registered by at least one corresponding photoregistrar" to mean each photoregistrar (Fig. 5 detector 642 and ADC 644) is monochromic and only reads a specific spectral range (Para 73).

As to claim 70, Yukhin teaches the 3D imaging camera claim 65, further comprising a computing device (electronic unit 690) communicatively coupled to said image sensor (642A – 642N) in which said computing device (690) is configured to combine said separate image data sets (660A – 660N) into a composite Rainbow-type image of said object(695) (Para 70 – 75). Yukhin teaches the resultant processed digital signal such as reconstructed 3D topology from signal processors 660A-660N may be accumulated in electronic unit 690. For example, processor 670 of electronic

unit 690 may sum the signals received from each of signal processors 660A-660N to create an "overall" digital image (Para 75).

As to claim 71, Yukhin teaches the 3D imaging camera claim 68, in which each of said charge-coupled device (CCD) sensors (642A - 642N) comprise a matched narrow-band spectral filter (beam splitter 615) disposed in front of said CCD sensor (642A - 642N) (Para 72 and 73). Yukhin teaches structured illumination using differing spectral ranges is used, each of the N spectral ranges is registered by at least one corresponding photoregistrar of identical spectral sensitivity (Para 73). Thus, each image of the structured illumination distortions, formed by heterogeneities of a shape of the object surface, is registered in at least one channel of at least one multi-channel unit of image registration and processing.

As to claim 72, Yukhin teaches the 3D imaging camera claim 68, in which each of said number of sequential light beam projections (510A-510N) projects light in a unique spectrum band (visible, ultraviolet or infrared range) corresponding to one of said charge-coupled device (CCD) sensors (642A – 642N) (Para 53 and 73). Yukhin teaches structured illumination using differing spectral ranges (infrared spectrum) is used, each of the N spectral ranges is registered by at least one corresponding photoregistrar (640A – 640N) of identical spectral sensitivity (Para 73).

6. Claim 73 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yukhin (US Patent Pub. # 2003/0235335) in view of Hasegawa (US Patent # 5,014,121).

As to claim 73, note the discussion above. Yukhin does not specifically teach light beam projections each of a different color within the visible spectrum. Hasegawa (Fig. 1) teaches the sequential color projections (filter disk 8) from said projector (9) project onto said object to be photographed. Hasegawa shows in figure 4 the filter disc (8) is constructed in such a way that filters 8a, 8b and 8c having such spectral transmittances as will transmit there through only R light, only G light and only B light, respectively, are arranged at an equal interval from each other on a same circumference (Col. 5, line 65 – Col. 6, line 13). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have provided filter disk as taught by Hasegawa to the illuminating unit of Yukhin, to provide an image pickup device which eliminates degradation of the integrated color image brought about by chromatic aberration of the images for the respective colors (Col. 1, lines 65 - 68 of Hasegawa).

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHRISTOPHER K. PETERSON whose telephone number is (571)270-1704. The examiner can normally be reached on Monday - Friday 6:30 - 4:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tran Sinh can be reached on 571-272-7564. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/C. K. P./
Examiner, Art Unit 2622
1/20/2010

/Sinh Tran/
Supervisory Patent Examiner, Art Unit 2622